Instrument Incubator

Three Band Cloud and Precipitation Radar (3CPR)

Completed Technology Project (2014 - 2017)

Project Introduction

We propose to design and demonstrate key enabling technologies for Cloud and Precipitation radars capable of closing the observational gaps left by current and upcoming missions (i.e., TRMM, CloudSat, GPM and EarthCARE), and identified by the cloud-precipitation science community as essential for the advancement of global characterization of the cloud-precipitation processes and their correct modeling in weather and climate models. The proposed instrument is Three-band (Ku/Ka/W-band) Cloud and Precipitation Radar (3CPR). 3CPR enables the simultaneous three-band observation, Doppler measurement, cross-track electronic scanning, and polarimetry). 3CPR achieves this using an extremely versatile and efficient antenna system referred to as ACPRA (Advanced Cloud and Precipitation Radar Antenna). ACPRA combines the high gain of a large parabolic-cylindrical reflector with the beam agility of an electronically-scanned feed system. The 3CPR configuration fulfills the draft requirements of a Global Cloud and Pre-cipitation Mission (GPCM). The Ka-/W-band subset of the 3CPR design satisfies all of the requirements and most of the goals of the Aerosol/Cloud/Ecosystems (ACE) mission. It would also meet the requirements set by the snowfall measurement community. The key enabling technology meeting the requirements of GPCM and ACE is the W-band ACPRA. Using recent technological advancements in microfabricated interconnects and radiators, GaN and SiGe MMICs together with innovations in feed array design, we will demonstrate a W-band electronically-scanned array-fed reflector system. The reflector will be a scaled version of the 3CPR antenna with W-band scanning electronics. We will demonstrate this technology in thermal vacuum and vibration environments, advancing the key technology from TRL3 to TRL5. This TRL advancement along with a comprehensive instrument design and accommodation study to be performed during this task will bring the 3CPR instrument to TRL5, ready for Phase A start for ACE, GPCM, or other mission concepts by 2017.

Develop and demonstrate key enabling technologies for a spaceborne three-band (Ku/Ka/W-band) 3CPR capable of simultaneous three-frequency, Doppler, cross-track scanning, and polarimetric measurements of hydrometeors (clouds, rainfall, snowfall). 3CPR will: - enable global characterization of cloud-precipitation processes and their correct representation in weather and climate models - fulfill all radar requirements for the ACE measurement concept, the anticipated radar requirements in the post-GPM mission era, and those set by snowfall science community. Special emphasis will be placed on developing 3CPR's electronic scanning antenna – the Advanced Cloud and Precipitation Radar Antenna (ACPRA).

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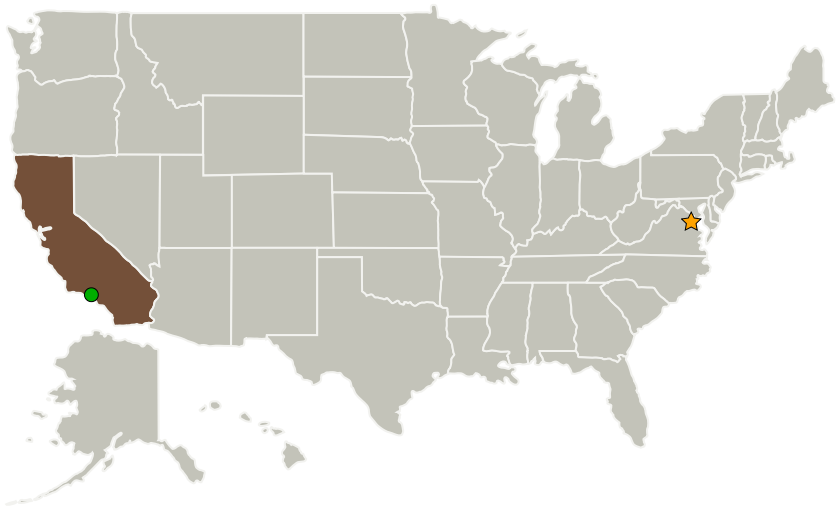
Completed Technology Project (2014 - 2017)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★NASA Headquarters(HQ)	Lead Organization	NASA Center	Washington, District of Columbia
●Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:
Science Mission Directorate (SMD)

Lead Center / Facility:
NASA Headquarters (HQ)

Responsible Program:
Instrument Incubator

Project Management

Program Director:
Pamela S Millar

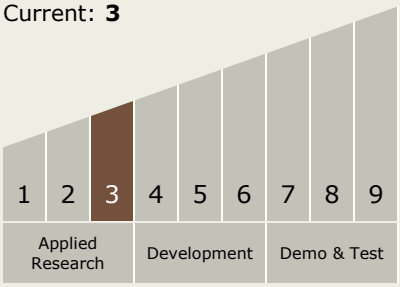
Program Manager:
Parminder S Ghuman

Principal Investigator:
Gregory A Sadowy

Co-Investigator:
Karen R Piggee

Technology Maturity (TRL)

Start: **3**
Current: **3**



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Images

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(https://techport.nasa.gov/image/5135)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

Target Destination

Earth